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वस्त्रादि — बुने हुए पालिएस्टर कपड़े के बने हुए जलरोधक तिरपाल — विशिष्टि

Indian Standard

TEXTILES — WATERPROOF TARPAULINS MADE FROM WOVEN POLYESTER FABRIC — SPECIFICATION

ICS 13.340.99; 59.060.20; 59.080.30

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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Industrial Fabrics Sectional Committee, TXD 33

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Industrial Fabrics Sectional Committee had been approved by the Textile Division Council.

Tarpaulins are widely used for making tents, awnings, beach umbrellas and many other structural coverings and roofing suitable for outdoor and indoor uses such as temporary storage covers; railway wagon covers; automobiles and two wheeler covers; boat covers; swimming pool covers; water house and machinery covers; cotton bale and hay covers; lumber and grain covers; as well as for agricultural applications; etc. These are required to have high tearing resistance to prevent tearing of the tarpaulin fabric due to air winds and degradation during weathering. The dyes used in dyed tarpaulins should have high colour fastness to light which can be achieved by using dope dyed polyester fibre/yarn. The tarpaulins must meet functional requirement of providing waterproofing without allowing any penetration of water through the tarpaulin to protect the materials stored under them. Any waterproof finish imparted to the tarpaulin fabric must be durable.

The cotton tarpaulin fabrics used for these purposes need to be protected from rotting caused by microbial attack which is particularly a problem in the tropical and sub-tropical countries where hot and humid atmospheric conditions normally prevail which are congenial to microbial growth. For rot proofing, such cotton fabrics are treated with mixtures of chlorinated waxes, copper and antimony salts, 8-hydroxyquinoline salts, copper naphthenate, copper ammonium fluoride and chlorinated phenols that stiffen the fabric and give it a peculiar objectionable odour in addition to environmental pollution. For waterproofing also these fabrics are treated with wax emulsions containing paraffin wax, pigment and aluminium stearate which also stiffen the fabric especially in cold climates in addition to peculiar odour and environmental pollution. Further, such cotton fabrics are too heavy to handle easily. In view of the environmental and workplace hazards of these compounds, durable alternative products providing all such properties such as polyester tarpaulins, which have inherent resistance to microbial decomposition, are being increasingly used in most of the industrialized countries of the world.

The wax coating on cotton tarpaulin fabrics starts cracking. In addition, the rot proofing agents being semi-durable wash off in the rainy water over a period of time thus making these fabrics unsuitable for the desired end use in addition to degradation and thus poor durability of the fabric. Therefore, for end uses where longer durability, softness, easy handling and permanent finish is required, the latest anti-microbial polyester tarpaulins are lighter, more durable, permanently rot proof and water proof. These being lighter, soft and pliable are easy to handle. They are not degraded in the hot and humid atmospheric conditions prevalent in India.

The composition of the Committee responsible for the formulation of this standard is given in Annex H.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TEXTILES — WATERPROOF TARPAULINS MADE FROM WOVEN POLYESTER FABRIC — SPECIFICATION

1 SCOPE

This standard specifies constructional, performance and functional requirements of two varieties of water resistant and rot resistant tarpaulins made from polyester fabric, bleached and/or dope dyed based on end use application and mass per unit area that is light and medium varieties

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard, the definitions given below shall apply.

3.1 Tarpaulin — A covering or sheet of fabric resistant to the transmission of water and used to spread over anything to protect it from the adverse impact of weather elements.

3.2 Waterproof Tarpaulin — Tarpaulin that is impervious to water.

3.3 Waterproofing Content — The mass of waterproofing chemical in the unit area of the treated fabric expressed as a percentage of the mass per unit area of the untreated fabric.

4 MATERIALS AND ACCESSORIES

4.1 Yarn

4.1.1 The polyester yarn used in the manufacturing of tarpaulin fabrics shall be satisfactory in evenness and reasonably free from spinning defects such as slubs, snarls, knots, oily/greasy stains, yarn sleeving, etc.

4.1.2 The yarn shall be made from the dope dyed polyester fibres to meet the requirements of high colour fastness ratings to light and weathering.

4.2 Woven Fabric

4.2.1 For the manufacture of polyester tarpaulin, a rip-stop weave polyester woven fabric complying with the requirements specified in Table 1 shall be used. The polyester fabric shall be uniformly woven and the selvedges including woven and fringe selvedges, shall be firm and straight. It shall be well singed and shall be delivered dry and clean. It shall also be heat set.

4.2.2 Each piece of woven polyester fabric shall also be examined for major flaws (defects) as given in Annex B and shall meet the requirements specified in **8.2**.

4.3 Sewing Thread

Spun polyester sewing threads conforming to IS 9543 shall be used in the manufacture of tarpaulins using lock or chain stitching, and for working eyelets.

4.4 Rope Lashing

If required, lashing ropes shall be incorporated in the tarpaulins. Sisal (aloe fibre) or hemp rope lashings conforming to IS 5176 of 12 mm diameter and made from three strands for tarpaulins of sizes 5.5 m^2 and above, and of 8 mm diameter for sizes below 5.5 m^2 shall be used. The length of the splicing shall be about 75 mm in case of 8 mm diameter rope and about 100 mm in case of 12 mm diameter rope with at least three tucks of each strand in each case.

4.5 Twine Whipping

Twine whipping of spun polyester sewing thread conforming to IS 9543 with at least 20 mm length shall be used.

4.6 Eyelets

Unless otherwise agreed to between the buyer and the seller, aluminium alloy or brass eyelets provided with reinforcement pieces (washers) conforming to size 30 of IS 4084 shall be used.

4.7 Line/Cord Beading

A line/cord beading of minimum 2.5 mm diameter shall be provided along the length and width of the tarpaulin.

5 MANUFACTURE

5.1 Stitching

The tarpaulins shall be stitched by using chain or lock stitch with 18 to 20 stitches per decimeter. If a break in stitching occurs, the overlap of new stitching shall be not less than 7.5 cm.

NOTE — The stitch tension shall be uniform.

5.2 Seams

The material shall be joined by flat seaming with not less than 25 mm overlap. Seams shall be overlapped from the middle of the tarpaulin outwards in order to form a watershed on the top side. Seams shall be secured by either a double row of lock stitching or a double or triple row of chain stitching.

5.3 Hems

A 25 mm deep hem shall be formed on all sides. Raw edges shall be turned in. Hems shall be sewn using a single lock stitch and using spun polyester sewing thread conforming to IS 9543.

5.4 Fixing of Eyelets

Where eyelets are required, holes punched to receive them shall be smaller than the outside diameter of the barrel, so that the barrel has to be forced through the hole. The eyelets shall be clinched without cutting the fabric. The number and position of metal eyelets shall be as agreed to between the buyer and the seller. The eyelets shall be provided with the reinforcement pieces. The outer edge of the eyelet shall be as close as possible to the line beading.

6 REQUIREMENTS

6.1 Constructional Requirements

6.1.1 The tarpaulin fabric shall conform to the constructional requirements of fibre composition, weave, threads per decimetre, finished mass (g/m^2), length and width as specified in Table 1.

6.1.2 *Tolerance on Dimensions and Mass*

The tarpaulins shall be made to the shade and dimensions as specified in the contract or order. The following tolerance shall be permissible for length, width and mass (g/m^2):

Dimension	*Tolerance*, Percent
Ends and Picks per decimetre	+ 5.0 – 2.5
Length	+ 1 (no minus tolerance permitted)
Width	± 1
Mass (g/m^2)	± 5 percent on declared mass

6.2 Performance Requirements

6.2.1 The tarpaulin fabric shall conform to the performance requirements of *p*H value of aqueous extract, breaking strength, tearing strength, relaxation shrinkage, waterproofing content, copper and zinc contents, colour fastness, loss of volatile matter on heating and ash content as specified in Table 1.

6.3 Functional Requirements

6.3.1 *Waterproofing*

The tarpaulin fabric shall conform to the requirements of waterproofing as specified in Table 1 when tested by cone test according to IS 7941 and for hydrostatic pressure head test according to IS 391. The waterproofing content shall be as specified in Table 1 when tested by the method prescribed in Annex C.

6.3.1.1 The test specimen shall be so selected that at least one joint is covered.

6.3.2 *Resistance to Micro-organisms*

The tarpaulin fabric shall be resistant to micro-organisms and conform to the requirements specified in Table 1 in respect of breaking strength after soil burial for 7 days in accordance with IS 1389.

6.3.3 *Resistance to High Temperatures*

The tarpaulin fabric shall conform to the requirement of resistance to high temperature as specified in Table 1 when tested in accordance with the method given in Annex F.

NOTE — This test is intended to establish that the impregnated fabric does not become tacky in storage or in use at temperatures up to 60°C which normally occur in tropics and it is essential that the fabric does not stick to itself or to other articles with which it may come in to contact.

6.3.4 *Resistance to Low Temperatures*

The fabric shall conform to the requirement of resistance to low temperatures as specified in Table 1 when tested in accordance with the method given in Annex G.

6.3.5 *Flame Resistance*

If required by the buyer, the tarpaulin fabric shall be made inherently flame resistant by using inherently flame retardant polyester fibres in the manufacture of fabric and shall meet the requirements of Flame Spread Index 3 as specified in IS 15742.

7 MARKING

7.1 Each tarpaulin shall be legibly marked with the following information at one corner on one side either with tag or by printing on it with the indelible ink:

a) Name and address of the manufacturer,
b) Variety type,
c) Dimensions and declared mass (g/m^2),
d) Year of manufacture,
e) The words ‘Flame Resistant’ in case the flame resistance requirement is applicable,
f) Any other information as required by the law in force.

7.2 BIS Certification Marking

The tarpaulins may also be marked with the Standard Mark.

7.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and Rules and Regulations made thereunder. The details of the conditions under which a license for the use of the Standard Mark may be granted to

Table 1 Constructional, Performance and Functional Requirements of Tarpaulin

(*Clauses* 4.2.1, 6.1.1, 6.2.1, 6.3.1, 6.3.2, 6.3.3 *and* 6.3.4)

Sl No.	Characteristic(s)	Requirement(s)		Method of Test, Ref to
		Light Variety	Medium Variety	
(1)	(2)	(3)	(4)	(5)
A. Constructional Requirements				
i)	Fibre composition, percentage of polyester	← 97 to 100 percent units →		IS 3416 (Part 1)
ii)	Linear density of yarn1)			IS 3442
	a) Warp	2/25 tex (2/24s)	2/59 tex (2/10s)	
	b) Weft	2/30 tex (2/20s)	2/59 tex (2/10s)	
iii)	Weave	Rip-stop	Rip-stop	
iv)	Threads per dm, *Min*:			IS 1963
	a) Ends	360	205	
	b) Picks	165	125	
v)	Finished mass, g/m^2, *Min*	380	515	IS 1964
vi)	Length, m, tolerance	As agreed or declared		IS 1954
vii)	Width, m, tolerance	As agreed or declared		IS 1954
B. Performance Requirements				
i)	*p*H value of aqueous extract	← 6.5 to 7.5 →		IS 1390 (Cold method)
ii)	Breaking strength on 5 cm × 20 cm strip, N, *Min*			IS 1969 (Part 1)
	a) Warp way	1 840	3 000	
	b) Weft way	1 770	2 300	
iii)	Tearing strength, N, *Min*			IS 7016 (Part III)
	a) Warp way	170	290	
	b) Weft way	155	340	
iv)	Relaxation shrinkage, percent, *Max* (warp way and weft way)	1.0	1.0	IS 2977
v)	Waterproofing content, percent, *Max*	25	25	Annex C
vi)	Copper (Cu) content	Nil	Nil	IS 6803
vii)	Zinc (Zn) content	Traces	Traces	IS 6803
viii)	Minimum colour fastness rating to Artificial light (change in colour)	5	5	IS 2454
ix)	Loss of volatile matter on heating, 105°C for 1 h, percent, *Max*	1.0	1.0	Annex D
x)	Ash content	1.0	1.0	Annex E
C. Functional Requirements				
i)	Waterproofing			
	a) Cone test			IS 7941
	1) Leakage of water, ml	Nil	Nil	
	2) Wetting of outer surface	No wetting	No wetting	
	b) Hydrostatic pressure head test, height of water column for first three drops, cm, *Min*	25	30	IS 391
ii)	Resistance to micro-organisms, breaking strength after soil burial for 7 days, percent of original breaking strength of fabric, *Min*	80	80	IS 1389
iii)	Resistance to high temperatures, sticking of fabric to itself or other articles	No sticking	No sticking	Annex F
iv)	Resistance to low temperatures, development of cracks, if any	No cracks	No cracks	Annex G

1) For guidance only

manufacturers or producers may be obtained from the Bureau of Indian Standards.

8 SAMPLING AND CRITERIA FOR CONFORMITY

8.1 Lot

The quantity of tarpaulin fabric of same type, size and mass (g/m^2) manufactured under similar conditions and delivered to a buyer against one dispatch note shall constitute a lot.

8.2 Random samples shall be drawn from the lot for testing so as to be representative of the lot. The conformity of a lot to the requirements of this standard shall be determined on the basis of the tests carried out on the samples selected from it. A piece shall be considered non-conforming if it contains more than one major flaw or if it does not meet any of the requirements specified in this standard.

8.3 Unless otherwise agreed to between the buyer and the seller, the number of pieces to be selected at random from a lot shall be as given in col 3 of Table 2.

Table 2 Sample Size and Criteria for Conformity
(*Clauses* 8.3 *and* 8.4)

Sl No. (1)	Number of Pieces in the Lot (2)	Number of Pieces to be Selected (3)	Permissible Number of Non-conforming Pieces (4)
i)	Up to 50	5	0
ii)	51 to 150	8	0
iii)	151 to 300	13	1
iv)	301 to 500	20	1
v)	501 and above	32	2

8.4 The number of test samples and criteria for conformity of a lot for various requirements shall be as follows:

Characteristics	*Number of Test Samples*	*Criteria for Conformity*
Manufacture, materials and accessories	According to col 3 of Table 2	No non-conforming piece to be permitted
Weave, threads/dm, mass/m^2, length, width	According to col 3 of Table 2	Non-conforming pieces shall not exceed the corresponding number given in col 4 of Table 2
*p*H value, relaxation shrinkage, breaking strength, tearing strength, loss of volatile matter on heating, colour fastness, Cu and Zn contents, fibre composition, waterproofing content, ash content and functional requirements	One specimen from each lot from the rolls/pieces selected in col 3 of Table 2	Non-conforming pieces shall not exceed the corresponding number given in col 3 of Table 2

ANNEX A
(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
391 : 1975	Method for determining resistance to penetration by water of fabrics by hydrostatic head test (*first revision*)
1389 : 1969	Methods for testing cotton for resistance to attack by micro-organisms
1390 : 1983	Methods for determination of *p*H value of aqueous extracts of textile materials (*first revision*)
1954 : 1990	Determination of length and width of woven fabrics — Methods (*second revision*)
1963 : 1981	Methods for determination of threads per unit length in woven fabrics (*second revision*)
1964 : 2001	Methods for determination of mass per unit length and mass per unit area of fabrics (*second revision*)

IS No.	*Title*
1969 (Part 1) : 2009	Textiles — Tensile properties of fabrics — Determination of maximum force and elongation at maximum force : Part 1 Strip method (*third revision*)
2454 : 1985	Methods for determination of colour fastness of textile materials to artificial light (Xenon arc lamp) (*first revision*)
2977 : 1989	Fabrics (other than wool) — Method for determination of dimensional changes on soaking in water (*first revision*)
3416 (Part 1) : 1988	Method for quantitative chemical analysis of mixtures of polyester fibres with cotton or regenerated cellulose: Part 1 Sulphuric acid method (*second revision*)
3442 : 1980	Method for determination of crimp and count of yarn removed from fabrics (*first revision*)
4084 : 1978	Specifications of eyelets and washers (sail) (*first revision*)
5176 : 1985	Hawser-laid hemp ropes (*first revision*)
6359 : 1971	Method for conditioning of textiles
6803 : 1972	Special proofed canvass and duck
7016 (Part III) : 1981	Methods of test for coated and treated fabrics: Part III Tear strength (*first revision*)
7941 : 1976	Methods for determining water repellency of fabrics by cone test
9543 : 1980	Spun polyester sewing threads
15742 : 2007	Textiles — Requirements for clothing made of limited flame spread materials and material assemblies affording protection against heat and flame — Specification

ANNEX B

(*Clause* 4.2.2)

CATEGORIZATION OF FLAWS

B-1 MAJOR FLAWS

B-1.1 One or more ends missing in the body of the material throughout its length, more than three ends missing at a place and running over 50 cm, or prominently noticeable double end running throughout the piece.

B-1.2 Undressed snarls noticeable over a length exceeding 5 percent of the length of the piece.

B-1.3 Smash definitely rupturing the texture of the fabric.

B-1.4 Hole, cut or tear.

B-1.5 Reed marks prominently noticeable over a length exceeding 5 percent of the piece.

B-1.6 Defective or damaged selvedge noticeable over a length exceeding 5 percent of the length of the piece.

B-1.7 Skewing of more than 3 percent on weft.

B-1.8 Weft crack or two or more missing picks across the width of the fabric.

B-1.9 Warp or weft bar due to the difference in raw material, count, twist, luster, colour, shade or spacing of adjacent groups of yarns (starting mark).

B-1.10 More than two adjacent ends running parallel, broken or missing and extending beyond 10 cm.

B-1.11 Noticeable warp or weft float in the body of the fabric.

B-1.12 Noticeable oil or other stain in the fabric.

B-1.13 Oily weft in the fabric.

B-1.14 Prominently noticeable slub.

B-1.15 Conspicuous broken pattern.

B-1.16 Gout due to foreign matter, usually lint or waste woven into the fabric.

B-1.17 Prominent selvedge defect.

B-1.18 Significant shading or listing in fabrics having a gradual change in tone or depth of shade of fabric (excluding selvedge or border running parallel to the selvedge).

B-1.19 Coloured flecks.

B-1.20 Blurred or dark patch.

B-1.21 Patchy, streaky or uneven dyeing.

B-1.22 Dye bar.

B-1.23 Fuzzy appearance.

ANNEX C

(*Clause* 6.3.1 and *Table* 1)

DETERMINATION OF WATERPROOFING CONTENT

C-1 PROCEDURE

C-1.1 Cut four pieces of the material 8 cm × 8 cm accurately from different places in a sample of tarpaulin and condition them for 24 h under standard atmospheric conditions of 27 ± 2°C temperature and 65 ± 2 percent relative humidity (*see* IS 6359).

C-1.2 Weigh the conditioned pieces accurately and subject them to successive extraction in a Soxhlet apparatus with: (a) carbon tetrachloride for 3 h, (b) rectified spirit for 2 h, and (c) water for 2 h. After this treatment, the material may contain pigments in the interstices of the fabric. To remove these, separate individual threads from the pieces, collect together and give light treatment with soap. Wash the threads thoroughly with water to remove last traces of soap.

C-1.3 Dry and condition the specimen in the standard atmosphere of 27 ± 2°C temperature and 65 ± 2 percent relative humidity for 24 h and weigh.

C-1.4 Calculate the total mass of the waterproofing from the difference between the initial mass of the test pieces and the mass of the threads (**C-1.2**) expressed as a percentage of the mass of the threads (**C-1.2**)

ANNEX D

(*Table* 1)

DETERMINATION OF LOSS OF VOLATILE MATTER ON HEATING

D-1 PRINCIPAL

Test specimen are dried in an oven to constant mass and the volatile matter content is calculated as percentage of the mass lost in drying.

D-2 APPARATUS

D-2.1 Drying Oven — ventilated, preferably air-circulating type, capable of being controlled at 105 ± 5°C.

D-2.2 Analytical Balance — accurate to 0.1 g.

D-2.3 Glass Plates — minimum two in number, having approximate dimensions of 125 mm × 175 mm, for use when heating the test specimens.

D-2.4 Desiccator

D-3 PREPARATION OF SPECIMENS

Take three test specimens 100 mm × 25 mm, equally spaced across the width of the fabric.

D-4 PROCEDURE

D-4.1 Condition the test specimens in the standard atmosphere of 27 ± 2°C temperature and 65 ± 2 percent relative humidity for 24 h.

D-4.2 Weigh a test specimen in the analytical balance (**D-2.2**) accurately nearest to 0.1 g. Let the mass of the test specimen be m_1.

D-4.3 Place the test specimen between a pair of glass plates (**D-2.3**) and then in the drying oven (**D-2.1**).

D-4.4 Dry the test specimen for 1 h to constant mass in the drying oven (**D-2.1**) controlled at 105 ± 5°C temperature with the ventilators open and with the circulating fan, if fitted, switched on.

NOTE — The mass shall be taken as constant if the difference between any two successive weighing does not exceed 10 percent.

D-4.5 Remove the test specimen and the pair of glass plates from the oven, cool the test specimen in a desiccator (**D-2.4**) and weigh it nearest to 0.1 g. Let this mass be m_2.

D-4.6 Calculate the volatile matter in percentage by mass (v) by the formula:

$$v = \frac{m_1 - m_2}{m_1} \times 100$$

D-4.7 Repeat the test with the remaining test specimens.

ANNEX E

(*Table* 1)

DETERMINATION OF ASH CONTENT

E-1 Incinerate about 5 g of the test piece to ash in a muffle furnace.

E-2 Express the ash as a percentage of the mass of the tarpaulin fabric taken for test.

ANNEX F

(*Clause* 6.3.3 and *Table* 1)

DETERMINATION OF RESISTANCE TO HIGH TEMPERATURES

F-1 PRINCIPAL

Specimen are conditioned in the standard atmosphere of 27 ± 2°C temperature and 65 ± 2 percent relative humidity for 24 h and subjected to a specified high temperature of 60 ± 2°C in a drying oven under pressure and then checked for stickiness to itself and with stainless steel plates.

F-2 APPARATUS

F-2.1 Drying Oven — Ventilated, air-circulating type, capable of being controlled at 60 ± 2°C.

F-2.2 Stainless Steel Plates — Two in number, having approximate dimensions of 125 mm × 175 mm, each weighing about 500 g, for use when heating the test specimens.

F-2.3 Stainless steel weight piece of 500 g.

F-3 PREPARATION OF SPECIMENS

Take six specimens 100 mm × 25 mm, three cut in the warp direction and three cut in the weft direction equally spaced.

F-4 PROCEDURE

F-4.1 Condition the specimens in the standard atmosphere of 27 ± 2°C temperature and 65 ± 2 percent relative humidity for 24 h.

F-4.2 Place all the test specimens one above the other and place them between the stainless steel plates. Place the plates and the test specimens in the drying oven maintained at 60 ± 2°C temperature. Place the stainless steel weight piece of 500 g on the top plate and expose the test specimens at 60 ± 2°C for 1 h.

F-4.3 Remove the test specimens and the stainless steel plates along with the stainless steel weight piece from the drying oven and check whether:

a) the different test specimens can be separated from each other without lifting the specified weight piece; and

b) the test specimens do not stick to themselves or to the stainless steel plates.

F-5 REPORT

Report any sign of sticking of the test specimens among themselves or with the stainless steel plates without the lifting of the stainless steel weight piece.

ANNEX G

(*Clause* 6.3.4 and *Table* 1)

DETERMINATION OF RESISTANCE TO LOW TEMPERATURES

G-1 PRINCIPAL

Specimen are conditioned in the standard atmosphere of 27 ± 2°C temperature and 65 ± 2 percent relative humidity for 24 h and subjected to a specified low temperature, bent around a mandrel and examined for cracking.

G-2 APPARATUS

G-2.1 Refrigerator/Cold Chamber — Capable of maintaining a temperature of –20 ± 2°C and sufficient in size to contain the bending mandrel and its supporting means as well as the test specimens.

G-2.2 Mandrel — 7 ± 1 mm diameter.

G-2.3 Means for Supporting the Mandrel — For example, two laboratory stands with clamps of low thermal conductivity.

G-2.4 Glass Plates — Glass plates of sufficient number, having approximate dimensions of 125 mm × 175 mm, for use when conditioning the test specimens.

G-2.5 Gloves — For handling the test specimens within the cold chamber. The gloves will be conditioned at the same temperature as the test specimens. A second pair of gloves at room temperature shall therefore be available for wearing within the cold gloves as protection for the operator.

G-3 PREPARATION OF SPECIMENS

Take six specimens 100 mm × 25 mm, three cut in the warp direction and three cut in the weft direction equally spaced.

G-4 PROCEDURE

G-4.1 Condition the specimens in the standard atmosphere of 27 ± 2°C temperature and 65 ± 2 percent relative humidity for 24 h.

G-4.2 Place the specimens between glass plates (**G-2.4**), with sufficient space between each test specimen to permit the passage of air during the conditioning period.

G-4.3 Place the glass plates (**G-2.4**) with the test specimens held in position , the bending mandrel and its support and the cold gloves in the refrigerator/cold chamber (**G-2.1**) along with the mandrel (**G-2.2**) and allow them to remain for 4 h at a temperature of – 20 ± 2°C.

G-4.4 Remove the mandrel from the refrigerator and support it in the holder (**G-2.3**).

G-4.5 Remove one specimen at a time from the refrigerator and place it horizontally and symmetrically above and in contact with the mandrel such that the major axis of the specimen lies perpendicular to the axis of the mandrel.

G-4.6 Bring the two ends of the specimen together beneath the mandrel such thus subjecting the specimen to a bend of 180° around the mandrel.

G-4.7 Repeat the procedure from **G-4.1** to **G-4.6** as quickly as possible with the remaining specimens.

NOTE — Gloves must be worn all the times when handling test specimens prior to making the bend test.

G-5 REPORT

Report any sign of cracking and length of crack.

ANNEX H

(*Foreword*)

COMMITTEE COMPOSITION

Industrial Fabrics Sectional Committee, TXD 33

Organization	*Representative(s)*
The Bombay Textile Research Association, Mumbai	Shri A. N. Desai (***Chairman***)
Central Road Research Institute, New Delhi	Shri Sudhir Mathur Shri Jai Bhagwan (*Alternate*)
Charminar Nonwovens Pvt Ltd, Hyderabad	Managing Director
Coir Board, Kochi	Dr U. S. Sharma Shri M. Kumaraswamy Pillay
Directorate General of Supplies & Disposals, New Delhi	Addl Director General (QA)
E. I. Du Pont India Pvt Ltd, Gurgaon	Ms Vedika Kapoor
Garware Wall Ropes Ltd, Pune	Shri S. J. Chitnis
Gujarat Engineering Research Institute, Vadodara	Shri L. V. Ashrara
Indian Jute Industries' Research Association, Kolkata	Shri D. K. Biswas Shri Koushik Das (*Alternate*)
Jaya Shree Textiles, Indian Rayon & Industries Ltd, Hooghly	Shri Pawan Sharma
Kusumgar Corporates, Mumbai	Shri Y. K. Kusumgar Dr M. K. Talukdar (*Alternate*)
Madura Coats Ltd, Madurai	Shri R. M. Sambandam Shri N. Nadarajan (*Alternate*)
National Institute of Research on Jute and Allied Fibre Technology, Kolkata	Shri Gautam Bose Dr Sanjoy Debnath (*Alternate*)
Office of the Textile Commissioner, Mumbai	Shri Ajay Pandit Shri M. Baluchamy (*Alternate*)
Oriental Synthetic & Rayon Mills Pvt Ltd, Mumbai	Shri Vishwanath S. Chalke Shri Satish Kumar P. Nikam (*Alternate*)
Premier Polyfilms Ltd, Ghaziabad	Shri Sanjeev Verma Shri Harinder Kumar (*Alternate*)
PSG College of Technology, Coimbatore	Shri R. G. Shekar Shri V. Muthukumar (*Alternate*)
Reliance Industries Limited, Navi Mumbai	Dr Anup Rakshit Shri Anurag Shrivastava (*Alternate*)
Supreme Nonwovens Pvt Ltd, Hyderabad	Shri C. K. Chaudhari Shri C. K. Jain (*Alternate*)
Tech Fab India, Mumbai	Shri Anant Kannoi Dr Saurabh Vyas (*Alternate*)
The Synthetics & Art Silk Mills Research Association, Mumbai	Shrimati A. Sudam Dr Manisha Mathur (*Alternate*)
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